

## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

COCKBAIN, Julian  
Frank B. Dehn & Co.  
179 Queen Victoria Street  
London EC4V 4EL  
ROYAUME-UNI

Date of mailing (day/month/year)

17 September 2001 (17.09.01)

Applicant's or agent's file reference

44.68819/003

International application No.

PCT/GB00/00615

## IMPORTANT NOTIFICATION

International filing date (day/month/year)

22 February 2000 (22.02.00)

1. The following indications appeared on record concerning:

☒

the applicant

☐

the inventor

☐

the agent

☐

the common representative

Name and Address

AUSTEVOLL FISKEFØR AS  
N-5392 Storebo  
Norway

State of Nationality

NO

State of Residence

NO

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐

the person

☒

the name

☐

the address

☐

the nationality

☐

the residence

Name and Address

SEAGRAIN AS  
N-5392 Storebo  
Norway

State of Nationality

NO

State of Residence

NO

Telephone No.

Facsimile No.

Teleprinter No.

RECEIVED

FEB 11 2002

TC 1700

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒

the receiving Office

☐

the International Searching Authority

☐

the International Preliminary Examining Authority

☐

the designated Offices concerned

☒

the elected Offices concerned

☐

other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Idhir BRITEL

Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)  
20 October 2000 (20.10.00)

International application No.  
PCT/GB00/00615

Applicant's or agent's file reference  
44.68819/003

International filing date (day/month/year)  
22 February 2000 (22.02.00)

Priority date (day/month/year)  
23 February 1999 (23.02.99)

Applicant

SANDNES, Kjartan et al

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

15 September 2000 (15.09.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Zakaria EL KHODARY

Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

COCKBAIN, Julian  
Frank B. Dehn & Co.  
179 Queen Victoria Street  
London EC4V 4EL  
ROYAUME-UNI

Date of mailing (day/month/year)

28 September 2001 (28.09.01)

Applicant's or agent's file reference

44.68819/003

## IMPORTANT NOTIFICATION

International application No.

PCT/GB00/00615

International filing date (day/month/year)

22 February 2000 (22.02.00)

## 1. The following indications appeared on record concerning:

☒

the applicant

☐

the inventor

☐

the agent

☐

the common representative

Name and Address

AUSTEVOLL FISKEFØR AS  
N-5392 Storebo  
Norway

State of Nationality

NO

State of Residence

NO

Telephone No.

Facsimile No.

Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐

the person

☒

the name

☐

the address

☐

the nationality

☐

the residence

Name and Address

SEAGRAIN AS  
N-5392 Storebo  
Norway

State of Nationality

NO

State of Residence

NO

Telephone No.

Facsimile No.

Teleprinter No.

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

☒

the receiving Office

☐

the International Searching Authority

☐

the International Preliminary Examining Authority

☐

the designated Offices concerned

☒

the elected Offices concerned

☐

other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Idhir BRITEL

Telephone No.: (41-22) 338.83.38

## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

COCKBAIN, Julian  
Frank B. Dehn & Co.  
179 Queen Victoria Street  
London EC4V 4EL  
ROYAUME-UNI

Date of mailing (day/month/year)

06 December 2000 (06.12.00)

Applicant's or agent's file reference

44.68819/003

## IMPORTANT NOTIFICATION

International application No.

PCT/GB00/00615

International filing date (day/month/year)

22 February 2000 (22.02.00)

1. The following indications appeared on record concerning:



the applicant



the inventor



the agent



the common representative

Name and Address

COCKBAIN, Julian  
Frank B. Dehn & Co.  
179 Queen Victoria Street  
London EC4V 4EL  
United Kingdom

State of Nationality

GB

State of Residence

GB

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:



the person



the name



the address



the nationality



the residence

Name and Address

State of Nationality

GB

State of Residence

GB

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

Following an assignment the applicant in box 1 has been removed from the record.

4. A copy of this notification has been sent to:



the receiving Office



the International Searching Authority



the International Preliminary Examining Authority



the designated Offices concerned



the elected Offices concerned



other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer

Maria Victoria CORTIELLO

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38


**PCT**

REC'D 11 JUN 2001

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference 44.68811/003		<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/00615	International filing date (day/month/year) 22/02/2000	Priority date (day/month/year) 23/02/1999	
International Patent Classification (IPC) or national classification and IPC A23K1/00			
Applicant AUSTEVOLL FISKEFOR AS et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li><li>VIII <input checked="" type="checkbox"/> Certain observations on the international application</li></ul>			
Date of submission of the demand  15/09/2000		Date of completion of this report  07.06.2001	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  Rauter, A  Telephone No. +49 89 2399 8645	



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00615

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

### Description, pages:

1-14 as originally filed

### Claims, No.:

1-20 as originally filed

### Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00615

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims 1 - 20
	No:	Claims
Inventive step (IS)	Yes:	Claims
	No:	Claims 1 - 20
Industrial applicability (IA)	Yes:	Claims 1 - 20
	No:	Claims

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**SECTION V. ....**

1. Reference is made to the following documents:

D1: WO-A-9 738 590

D2: WPI/DERWENT AN-85-102393ç17 & JP-A-60 047 643 (English translation provided by the applicant)

D3: WO-A-9 216 115

D4: WPI/DERWENT AN-1986-172667 & JP-A-61 104 774 + JP-A-3 000 985

D5: Patent Abstracts of Japan, vol. 014, no. 290 (C-0731) & JP-A-02 092 243

D6: DD-A-126 289

D7: DE-A-19 503 092

2. The presently claimed subject-matter satisfies the criteria with respect to novelty (Rule 64(1)-(3) PCT) set forth in Article 33(1) PCT, but does not involve an inventive step (Rule 65(1)(2) PCT). The subject-matter is considered industrially applicable.

The process for production of a nutritional composition (claim 1) comprises the steps of emulsifying a material comprising raw fish material and heating it; and alternatively drying it.

The composition relates to a mixture of emulsified and coagulated raw fish or a mixture of emulsified and dried raw fish (claim 9).

A further composition contains fish oil and coagulated fish protein which is substantially free of muscle fibre fragments of a certain length (claim 10).

An apparatus (claim 16) comprises a grinder, an emulsifier, a dryer an optionally a heater.

- 2.1 The subject-matter as outlined above are considered formally novel since in the cited closest prior art, in particular since in D1 no reference directly to the feature is available that an emulsion is formed, or since in D2 no raw fish has been mentioned expressis verbis. There is also no disclosure of compositions according



to claims 9 and 10, or of an apparatus according to claim 16 available.

- 2.2 The problem to be solved by present application is to be seen in the provision of a process for the production of a nutritional composition, in particular of a fish-based fodder. For such a problem, document D2 (see eg the abstract) is considered to represent the closest prior art since the same objectives are mentioned and the process disclosed differs (as outlined above) essentially only in that fish meat has been used in the known process in place of raw fish material. However, considering raw fish material for fish meat in the process appears well within the knowledge of a person skilled in the art. Additionally, the person skilled in the art will take from D1, which deals with the same problem and also provides fish-based fodder, that whole fresh fish material is useful for such purposes. Compositions as presently claimed in claims 9 and 10 will thus have been obtained in an obvious way, and the compositions certainly show the same stability. Concerning independent apparatus claim 16, the person skilled in the art concludes from the disclosure of eg D2 that an apparatus should comprise a grinder, an emulsifier (since ground fish meat was inter alia with an oil emulsified), a heater (for heat coagulation) and a dryer (eg a spray dryer).

It is at present not visible that dependent claims 2 - 8, 11 - 15 and 17 - 20 contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of an inventive step since eg spray drying (D2), microwave heating (D4), addition of eg gluten (D5), lipid contents as claimed (D1), water contents as claimed (D1), hot air driers (D6) etc. have been applied successfully in the prior art.

Further pertinent prior art is contained in the above cited documents.

- 2.3 The claimed subject-matter is industrially applicable.

## **SECTION VII. ....**

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 - D7 is not mentioned in the description, nor are

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00615

these documents identified therein.

**SECTION VIII. ....**

1. Although claims 9 and 10 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness. Hence, the said claims do not meet the requirements of Article 6 PCT.
2. In case the assumption under item 1., above, is wrong, then it is rather doubtful whether the international application relates to one invention only, ie whether the subject-matters defined in the independent claims are so linked as to form a single new general inventive concept (Rule 13 PCT).

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>44.68819/003</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 00615</b>	International filing date (day/month/year) <b>22/02/2000</b>	(Earliest) Priority Date (day/month/year) <b>23/02/1999</b>
Applicant <b>AUSTEVOLL FISKEFOR AS et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00615

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 A23K1/00 A23K1/18 A23L1/325 A23J3/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 A23K A23L A23J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 38590 A (SILVER FEED A S ; ELLINGSEN ALMAR (NO)) 23 October 1997 (1997-10-23) page 10, line 1 -page 13, line 26 page 21, line 4 -page 22, line 30 claim 1	1, 2, 9, 12, 13, 16
Y	DATABASE WPI Section Ch, Week 8517 Derwent Publications Ltd., London, GB; Class D13, AN 85-102393 XP002108524 -& JP 60 047643 A (QP CORP), 15 March 1985 (1985-03-15) abstract	1-3, 6, 9, 10, 12, 13, 16, 19



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

17 May 2000

Date of mailing of the international search report

30/05/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Dekeirel, M

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00615

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 92 16115 A (SILDOLJE & SILDEMELIND FORSK) 1 October 1992 (1992-10-01)  page 6, line 29 -page 7, line 8 claims 1,4,6,9  ----	1-3,6,9, 10,12, 13,16,19
A	DATABASE WPI Section Ch, Week 198627 Derwent Publications Ltd., London, GB; Class D13, AN 1986-172667 XP002137924 -& JP 61 104774 A (SANKAI KK), 23 May 1986 (1986-05-23) abstract  ----	1,2,4,7, 16,17
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 290 (C-0731), 22 June 1990 (1990-06-22) -& JP 02 092243 A (ITOCHU SHIRYO KK;OTHERS: 01), 3 April 1990 (1990-04-03) abstract  ----	1,8-11
A	DD 126 289 A (GENENTZ ALBRECHT;SCHMITZ GERD; EWALDT JUERGEN) 6 July 1977 (1977-07-06) page 4 -page 5; example claims 1,3 figures 1,2  ----	1,2,9,16
A	DE 195 03 092 C (WESTFALIA SEPARATOR AG) 27 June 1996 (1996-06-27) the whole document  -----	1,2,9,16

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

GB 00/00615

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9738590	A	23-10-1997	NO 961453 A AU 2578797 A CA 2251108 A EP 0893954 A	13-10-1997 07-11-1997 23-10-1997 03-02-1999
JP 60047643	A	15-03-1985	NONE	
WO 9216115	A	01-10-1992	NO 911008 A AU 1447792 A DK 101693 A GB 2273032 A,B GB 2285907 A,B NO 174794 B	15-09-1992 21-10-1992 10-09-1993 08-06-1994 02-08-1995 05-04-1994
JP 61104774	A	23-05-1986	JP 1638902 C JP 3000985 B	31-01-1992 09-01-1991
JP 02092243	A	03-04-1990	NONE	
DD 126289	A	06-07-1977	NONE	
DE 19503092	C	27-06-1996	DK 7196 A JP 8238076 A NO 960391 A ZA 9600317 A	02-08-1996 17-09-1996 02-08-1996 08-08-1996

## XP-002108524

1/1 - (C) WPI / DERWENT  
AN - 85-102393 ç17!  
AP - JP830154269 830824  
PR - JP830154269 830824  
TI - Prepn. of dry protein powder contg. oil and fat - by emulsifying protein material with oil and fat, thermal coagulation, crushing and spray-drying of prod.  
IW - PREPARATION DRY PROTEIN POWDER CONTAIN OIL FAT EMULSION  
PROTEIN MATERIAL OIL FAT THERMAL COAGULATE CRUSH SPRAY DRY PRODUCT  
PA - (QPPP ) QP CORP  
PN - JP60047643 A 850315 DW8517 004pp  
ORD - 1985-03-15  
IC - A23J3/00 ; A23K1/18  
FS - CPI  
DC - D13  
AB - J60047643 The method is characterised by (a) emulsifying the protein material showing heat-coagulating property with oil and fat, (b) heating-coagulating the emulsion, (c) crushing the coagulated prod. and (d) spray-drying the crushed prod.  
- Egg, soy bean protein, ground fish meat, lactoalbumin, etc. can be used as heat-coagulating protein, and vegetable or animal oil and fat can be used as oil and fat. Practically 10 pts. wt. of the aq. phase contg. heat-coagulating protein and 2-20 pts. wt. of oily phase are emulsified. The emulsion is heat-coagulated by heating it at 95-110 deg.C for 1-2 hrs. and heat-coagulated prod. is crushed to the granules of 50-100 microns dia. The granules have form of pasty substance and they are spray-dried by dissolving it in water and spray-drying to the granules of dia. 50-100 microns.  
- USE/ADVANTAGE - Dry protein powder contg. oil and fat is insoluble in water, thus when it is used as fish-raising feed, it gives high feeding efficiency without fouling water.(0/0)

**XP-002137924**

**AN - 1986-172667 [25]**

**AP - JP19840223048 19841025; JP19840223048 19841025**

**CPY - SANK-N**

**DC - D13**

**FS - CPI**

**IC - A23C19/00 ; A23G1/00 ; A23L1/20 ; A23P1/00**

**MC - D03-H01J**

**PA - (SANK-N) SANKAI KK**

**PN - JP61104774 A 19860523 DW198627 007pp**

**- JP3000985B B 19910109 DW199105 000pp**

**PR - JP19840223048 19841025**

**XA - C1986-074279**

**XIC - A23C-019/00 ; A23G-001/00 ; A23L-001/20 ; A23P-001/00**

**AB - J61104774 Formation of a food contg. high oil component, where a slurry regulated in an emulsion is extruded and heated in 120 deg.C or higher with a microwave under normal pressure to a reduced pressure to form an Irreversible gel. The emulsion is an oil in water type and substantially comprises sub-binding and binding water and contains bubble sol. and oil drops with ave. grain size of 20-500 microns, and at least a heat-coagulating protein and a saccharide.**

**- USE - To form a food contg. high oil into a gel material.**

**IW - FORMATION FOOD CONTAIN HIGH OIL COMPONENT COMPRISE EXTRUDE SLURRY HEAT FORM IRREVERSIBLE GEL**

**IKW - FORMATION FOOD CONTAIN HIGH OIL COMPONENT COMPRISE EXTRUDE SLURRY HEAT FORM IRREVERSIBLE GEL**

**NC - 001**

**OPD - 1984-10-25**

**ORD - 1986-05-23**

**PAW - (SANK-N) SANKAI KK**

**TI - Formation of food contg. high oil component - comprises extruding slurry and heating to form irreversible gel**



PUBLICATION NUMBER : 02092243  
PUBLICATION DATE : 03-04-90

APPLICATION DATE : 27-09-88  
APPLICATION NUMBER : 63239833

APPLICANT : KURITA WATER IND LTD;

INVENTOR : SHIMOYAMA MASAHIRO;

INT.CL. : A23K 1/18

TITLE : PRODUCTION OF FEED FOR THE YOUNG OF FISHES

ABSTRACT : PURPOSE: To obtain the feed for the young fishes which can be efficiently taken them by coagulating the powder of the feed with chitosan.

CONSTITUTION: The objective feed is obtained by coagulating the feed flour with chitosan. The feed for the young fishes are made depending on the kind of fishes. The components are, for example, fish flour, wheat gluten, casein, chrisalis flour, starch, dextrin, fish liver oil, essence of fish or shells, yeast essence, amino acids, vitamins, and medicines. The particle size of the feed flour is preferably about 1 to 100 microns. The chitosan is obtained by deacetylation of chitin in shells of shrimps or crabs. The deacetylation degree of chitosan may be at such a level as the deacetylated chitosan can be dissolved in an acidic aqueous solution, in a range from 50 to 100%.

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## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>44.68819/003</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/00615</b>	International filing date (day/month/year) <b>22/02/2000</b>	(Earliest) Priority Date (day/month/year) <b>23/02/1999</b>
Applicant <b>AUSTEVOLL FISKEFOR AS et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



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the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

## 4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

## 5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

GB 00/00615

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A23K1/00 A23K1/18 A23L1/325 A23J3/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A23K A23L A23J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 38590 A (SILVER FEED A S ; ELLINGSEN ALMAR (NO)) 23 October 1997 (1997-10-23) page 10, line 1 -page 13, line 26 page 21, line 4 -page 22, line 30 claim 1	1,2,9, 12,13,16
Y	DATABASE WPI Section Ch, Week 8517 Derwent Publications Ltd., London, GB; Class D13, AN 85-102393 XP002108524 -& JP 60 047643 A (QP CORP), 15 March 1985 (1985-03-15) abstract	1-3,6,9, 10,12, 13,16,19
	-/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the International search

17 May 2000

Date of mailing of the International search report

30/05/2000

Name and mailing address of the ISA

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## INTERNATIONAL SEARCH REPORT

International Application No

GB 00/00615

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 92 16115 A (SILDOLJE & SILDEMELIND FORSK) 1 October 1992 (1992-10-01)  page 6, line 29 -page 7, line 8 claims 1,4,6,9  ---	1-3,6,9, 10,12, 13,16,19
A	DATABASE WPI Section Ch, Week 198627 Derwent Publications Ltd., London, GB; Class D13, AN 1986-172667 XP002137924 -& JP 61 104774 A (SANKAI KK), 23 May 1986 (1986-05-23) abstract  ---	1,2,4,7, 16,17
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 290 (C-0731), 22 June 1990 (1990-06-22) -& JP 02 092243 A (ITOCHU SHIRYO KK;OTHERS: 01), 3 April 1990 (1990-04-03) abstract  ---	1,8-11
A	DD 126 289 A (GENENTZ ALBRECHT;SCHMITZ GERD; EWALDT JUERGEN) 6 July 1977 (1977-07-06) page 4 -page 5; example claims 1,3 figures 1,2  ---	1,2,9,16
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

GB 00/00615

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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JP 61104774	A	23-05-1986	JP 1638902 C JP 3000985 B	31-01-1992 09-01-1991
JP 02092243	A	03-04-1990	NONE	
DD 126289	A	06-07-1977	NONE	
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## XP-002108524

1/1 - (C) WPI / DERWENT  
AN - 85-102393 ç17!  
AP - JP830154269 830824  
PR - JP830154269 830824  
TI - Prepn. of dry protein powder contg. oil and fat - by emulsifying protein material with oil and fat, thermal coagulation, crushing and spray-drying of prod.  
IW - PREPARATION DRY PROTEIN POWDER CONTAIN OIL FAT EMULSION PROTEIN MATERIAL OIL FAT THERMAL COAGULATE CRUSH SPRAY DRY PRODUCT  
PA - (QPPP ) QP CORP  
PN - JP60047643 A 850315 DW8517 004pp  
ORD - 1985-03-15  
IC - A23J3/00 ; A23K1/18  
FS - CPI  
DC - D13  
AB - J60047643 The method is characterised by (a) emulsifying the protein material showing heat-coagulating property with oil and fat, (b) heating-coagulating the emulsion, (c) crushing the coagulated prod. and (d) spray-drying the crushed prod.  
- Egg, soy bean protein, ground fish meat, lactoalbumin, etc. can be used as heat-coagulating protein, and vegetable or animal oil and fat can be used as oil and fat. Practically 10 pts. wt. of the aq. phase contg. heat-coagulating protein and 2-20 pts. wt. of oily phase are emulsified. The emulsion is heat-coagulated by heating it at 95-110 deg.C for 1-2 hrs. and heat-coagulated prod. is crushed to the granules of 50-100 microns dia. The granules have form of pasty substance and they are spray-dried by dissolving it in water and spray-drying to the granules of dia. 50-100 microns.  
- USE/ADVANTAGE - Dry protein powder contg. oil and fat is insoluble in water, thus when it is used as fish-raising feed, it gives high feeding efficiency without fouling water.(0/0)

**XP-002137924**

**AN - 1986-172667 [25]**

**AP - JP19840223048 19841025; JP19840223048 19841025**

**CPY - SANK-N**

**DC - D13**

**FS - CPI**

**IC - A23C19/00 ; A23G1/00 ; A23L1/20 ; A23P1/00**

**MC - D03-H01J**

**PA - (SANK-N) SANKAI KK**

**PN - JP61104774 A 19860523 DW198627 007pp**

**- JP3000985B B 19910109 DW199105 000pp**

**PR - JP19840223048 19841025**

**XA - C1986-074279**

**XIC - A23C-019/00 ; A23G-001/00 ; A23L-001/20 ; A23P-001/00**

**AB - J61104774 Formation of a food contg. high oil component, where a slurry regulated in an emulsion is extruded and heated in 120 deg.C or higher with a microwave under normal pressure to a reduced pressure to form an irreversible gel. The emulsion is an oil in water type and substantially comprises sub-binding and binding water and contains bubble sol. and oil drops with ave. grain size of 20-500 microns, and at least a heat-coagulating protein and a saccharide.**

**- USE - To form a food contg. high oil into a gel material.**

**IW - FORMATION FOOD CONTAIN HIGH OIL COMPONENT COMPRISE EXTRUDE SLURRY HEAT FORM IRREVERSIBLE GEL**

**IKW - FORMATION FOOD CONTAIN HIGH OIL COMPONENT COMPRISE EXTRUDE SLURRY HEAT FORM IRREVERSIBLE GEL**

**NC - 001**

**OPD - 1984-10-25**

**ORD - 1986-05-23**

**PAW - (SANK-N) SANKAI KK**

**TI - Formation of food contg. high oil component - comprises extruding slurry and heating to form irreversible gel**

PUBLICATION NUMBER : 02092243  
PUBLICATION DATE : 03-04-90

APPLICATION DATE : 27-09-88  
APPLICATION NUMBER : 63239833

APPLICANT : KURITA WATER IND LTD;

INVENTOR : SHIMOYAMA MASAHIRO;

INT.CL. : A23K 1/18

TITLE : PRODUCTION OF FEED FOR THE YOUNG OF FISHES

ABSTRACT : PURPOSE: To obtain the feed for the young fishes which can be efficiently taken them by coagulating the powder of the feed with chitosan.

CONSTITUTION: The objective feed is obtained by coagulating the feed flour with chitosan. The feed for the young fishes are made depending on the kind of fishes. The components are, for example, fish flour, wheat gluten, casein, chrisalis flour, starch, dextrin, fish liver oil, essence of fish or shells, yeast essence, amino acids, vitamins, and medicines. The particle size of the feed flour is preferably about 1 to 100 microns. The chitosan is obtained by deacetylation of chitin in shells of shrimps or crabs. The deacetylation degree of chitosan may be at such a level as the deacetylated chitosan can be dissolved in an acidic aqueous solution, in a range from 50 to 100%.

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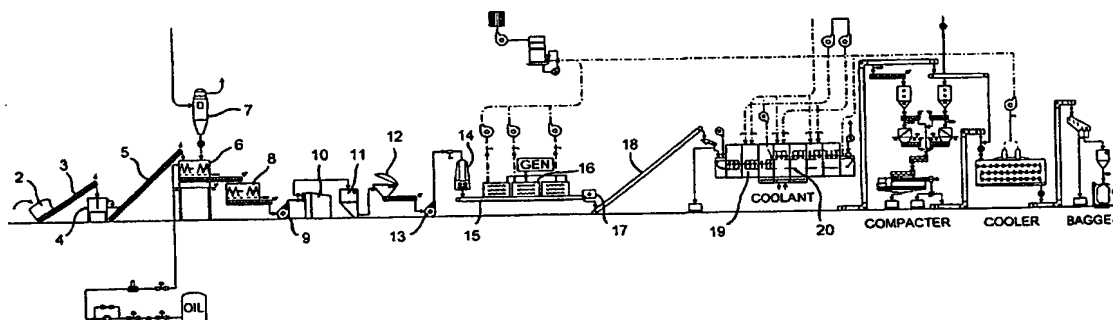
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : A23K 1/00, 1/18, A23L 1/325, A23J 3/04		A1	(11) International Publication Number: WO 00/49888
			(43) International Publication Date: 31 August 2000 (31.08.00)
(21) International Application Number: PCT/GB00/00615			(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (Utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date: 22 February 2000 (22.02.00)			
(30) Priority Data: 9904162.6 23 February 1999 (23.02.99) GB			
(71) Applicant (for all designated States except US): AUSTEVOLL FISKEFØR AS [NO/NO]; N-5392 Storebo (NO).			
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(72) Inventors; and (75) Inventors/Applicants (for US only): SANDNES, Kjartan [NO/NO]; Austevoll Fiskefôr AS, N-5392 Sorebo (NO). MARKI, Bjørn [NO/NO]; Silfas, Scottsgata 3, Postboks 4010, Dreggen, N-5023 Bergen (NO).			
(74) Agents: COCKBAIN, Julian et al.; Frank B. Dehn & Co., 179 Queen Victoria Street, London EC4V 4EL (GB).			

Published

With international search report.

(54) Title: PROCESS FOR THE PRODUCTION OF A NUTRITIONAL COMPOSITION



## (57) Abstract

A process for the production of a nutritional composition, feed or feedstuff, comprising emulsifying a mixture containing raw fish, followed by heating and/or drying said emulsion.

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Process for the Production of a Nutritional Composition

The present invention relates to a process for the preparation of a fish-based fodder and to the fodder so prepared.

Aquaculture, sometimes referred to as fish farming, is a rapidly growing industry and provides an increasing demand for fish-feed, ie. fodder. Currently major components of fish-feed are marine proteins (in the form of fish meal) and marine oils (in the form of fish oils).

The term "feed" is generally used in the art to describe a product which meets the daily nutritional needs of the creature being fed with it, ie. it contains all the essential nutrients. The term "feedstuff" in comparison is used to refer to a component of the complete feed, e.g. a protein or fish oil or a component containing the necessary proteins and oils but without the proper vitamin content. As used herein, the term "nutritional composition" includes both complete feeds and feedstuffs.

In aquaculture, in particular salmon and catfish farming, fodder pellets are used as feed. These pellets are usually made from fish meal and fish oil and result in a more efficient use of the raw material. Thus for example 10 kg of capelin used directly as food for cod leads to generation of about 2 kg of cod corresponding to about 0.7 kg of cod fillets. If instead 10 kg of capelin is processed to produce fish meal and fish oil and used as fodder for farmed salmon, the yield is about 4.6 kg salmon or 2.8 kg salmon fillet. The energy yield moreover is significantly greater: the cod fillet corresponds to about 3 MJ while the salmon fillet corresponds to about 28 MJ.

The fish meal and the fish oil are produced by cooking the raw material (fish), and pressing the cooked

material to separate it into three fractions: water; fish oil; and protein. The protein fraction, the dried solid remnant of the cooking and pressing process, is about 70% protein, 10% fat and 10% water and is milled to produce fish meal. The oil fraction can be used directly for animal/fish feed production or alternatively may be purified and used for human consumption.

While it is termed fish oil, a more accurate term is perhaps lipid; both terms will be used below.

In the production of feed pellets, fish oil, optionally together with plant oils, is sprayed onto pellets formed from fish meal, optionally together with plant carbohydrates. In this way pellets with a lipid content of up to about 35% by weight can be produced. Ideally, the lipid content should be higher for optimal growth promotion in farmed fish such as salmon. However in warm temperatures, for example those experienced in summer, there is significant leakage of lipids from the feed pellets - a 500 kg sack might release as much as 30 to 50 kg of lipids. Not only is this wasteful of fish oil, since the released oil will not be consumed by the fish, but it results in the fodder being messy and difficult to handle, it results in clogging of automatic feeding systems (which often rely on pneumatic feed distribution) and it is environmentally undesirable as it puts oil onto the water surface.

Moreover, processing the raw material (fish) to separate out fish meal and fish oil and then recombining these to produce feed pellets involves a considerable usage of energy and equipment.

An alternative process for fish fodder production has been described in NO 903175 (Hamre). In this process the raw material, e.g. whole fish, fish heads, fish entrails, etc., is ground up, mixed with wheat meal, pelletized and then cooked in a microwave oven to produce pellets which float in water and which have a

moisture content of 10 to 30%. The microwave cooking coagulates the protein and prevents the pellets from coalescing - however the problem of lipid release is not overcome and the water content is undesirably high unless the pellets are to be used immediately. For storage-stable fish feed pellets, the water content is desirably below 10% by weight.

We have now found that improved feed and feedstuff, particularly in the form of pellets, can be produced if, before heating and/or drying, the raw mixture is emulsified, e.g. to a mayonnaise-like consistency. If this is done, the lipid content can be increased without lipid leakage problems and storage-stable pellets with a low water content can be produced.

Viewed from one aspect therefore the invention provides a process for the production of a nutritional composition, said process comprising emulsifying a material comprising raw fish and heating and/or drying the resulting emulsion, preferably heating said emulsion to coagulate the protein therein.

In the process of the invention, the raw fish used may be whole fish or parts of fish, e.g. entrails, heads, tails, etc., for example the waste material from fish filleting or gutting. Fish of the same species as the intended consumers of the nutritional composition are not recommended for use as the raw fish.

Besides the raw fish, other substances may be included in the material which is emulsified, e.g. fish meal, fish silage (hydrolysed fish), plant carbohydrate (e.g. wheat meal, corn meal, etc.), fish oil, plant oil, colouring agents, vitamins, minerals, pharmaceuticals (e.g. antibiotics, growth promoters, etc.), and plant proteins, especially storage proteins and most particularly gluten.

These additional substances may serve to provide a balanced diet for the creatures fed with the nutritional composition, e.g. the vitamins and minerals; they may

serve to adjust the lipid/protein balance, e.g. where the raw fish used is low in lipids, fish or plant oils may be used to increase lipid content; they may, like the colouring agents, be used to make the flesh of farmed fish more closely resemble that of wild fish, which is particularly desirable for farmed salmon; or they may serve to improve or protect the health of the creature receiving the feed, e.g. where antibiotics are used. The use of plant storage proteins, in particular gluten, however is especially desirable as it significantly and surprisingly improves the texture, physical strength and lipid retention ability of the product.

Thus with such additional substances included, the product of the process of the invention is in one preferred embodiment, a complete feed, especially a feed in pellet form or a feed or feedstuff in granular form (e.g. in powder, grain or meal form).

The material which is emulsified and heated should have a sufficiently high protein content to be coagulatable on heating. Typically the protein content will be 30 to 60% by weight, e.g. 35 to 55%, preferably 38 to 45%, most preferably about 40% on a dry weight basis. Of this, up to 100% may be fish protein, preferably at least 50% deriving from the raw fish. However up to 50% by weight of the protein may be plant protein, preferably gluten. Gluten especially preferably contributes 0 to 40%, e.g. 5 to 40%, more preferably 5 to 30%, e.g. 10 to 30% or 15 to 25%, and most preferably 10 to 20% by weight of the total protein. Gluten is preferably used as such, ie. as gluten rather than only in carbohydrate-containing wheat flour.

The high protein content of the material to be emulsified also serves to enhance the formation of the emulsion by serving as an emulsifying agent. In addition, this effect may optionally be enhanced by the

use of at least one specific emulsifier.

The mixture which is emulsified, and preferably coagulated, will preferably have a lipid content of 15 to 55% by weight on a dry weight basis, more preferably 20 to 40%. This may derive completely from the raw fish; however typically up to 25% of the total lipids may derive from added plant or fish oils. Suitable plant and fish oils include oils from cod, capelin, herring, sprat, blue whiting, sand eel, Norway pout, soy, oilseed rape, mustard seed, sunflower, safflower, etc.

Vitamins, colouring agents, pharmaceuticals and minerals will generally form only a minor portion of the mixture which is to be emulsified and coagulated, e.g. up to 10% by weight on a dry solids basis. Appropriate amounts can readily be calculated from the appropriate dosages and feed consumption rates for the creatures receiving the feedstuff.

Carbohydrates, e.g. digestible plant starch, for example wheat starch, will generally constitute up to 20% by weight on a dry weight basis of the mixture which is emulsified and cooked, preferably 5 to 15%.

The water content of the mixture to be emulsified and cooked will generally be in the range 40 to 75% by weight, for example 55 to 75% or 60 to 70%, but most preferably 45 to 60%. After cooking and drying, this will preferably be reduced to 0.5 to 70%, especially preferably 2 to 10% and more particularly 3 to 8% where the feedstuff is to be stored before use.

In the process of the invention, the mixture to be emulsified is preferably prepared by grinding up, chopping or mincing the raw fish, for example whole herring, sprat, mackerel or capelin, and then mixing in the extra substances, e.g. wheat starch, vitamin mix, gluten (e.g. from wheat and/or maize) and colouring agents (e.g. astaxanthin or cantaxanthin for salmon feed). This coarse mixture is then emulsified, e.g.

using a microcutter such as the Simo Microcutter MC250/115 PFVB175SS from Simo Industries A/S of Denmark.

In the Simo Microcutter, the mixture is fed at up to 6 tonne/ hour through die plates with 4 and 2.5 mm apertures and emulsified by rotating knife plates. The resulting emulsion contains oil droplets of about 1 to 50  $\mu\text{m}$  maximum dimension (e.g. diameter) and is substantially free of larger solid particles, ie. particles larger than 50  $\mu\text{m}$ , other than bone fragments which typically may be 200-500  $\mu\text{m}$ . Typically the proportion (e.g. by volume) of solid particles (other than bone fragments) larger than 5  $\mu\text{m}$  visible by light microscopy is less than that of oil droplets of this size or larger, for example by a factor of at least 10, more usually at least 100. As mentioned above, the emulsion typically has a mayonnaise-like consistency. Viewed by light microscopy this appears to have all or substantially all of the components of the mixture as a continuous aqueous phase or a discontinuous oil phase. This is readily distinguished from the pre-emulsification mixture produced by chopping and grinding in which solid particles deriving from the raw fish, in particular muscle fibres and large bone fragments, are a prominent feature and lipid droplets are larger than in the emulsion.

After emulsification, the mixture is preferably exposed to a partial vacuum (e.g. 0.1 to 0.9 bar) to reduce the amount of entrained gas. This avoids the production of a feed which will float in water as floating feeds are not desired by salt water fish farmers. Moreover this reduces the oxygen tension (ie. oxygen content) and thereby reduces oxidation of the lipids in the composition. For catfish farming however a floating feed is desirable and degassing may be omitted or performed less completely. The final feedstuff desirably has a density in excess of 0.6 g/mL, preferably in excess of 1 g/mL, more preferably in



excess of 1.2 g/mL.

In one embodiment of the invention, following emulsification, and if desired degassing, the emulsion is heated to coagulate the proteins and generate a lipid-retaining matrix. This may be done in several ways, e.g. by passage over a heated surface, by passage through a hot air dryer, by steam heating, by heating with electromagnetic radiation, by infra red heating, etc. However microwave heating is preferred.

In the heating step, the temperature and time of heating should be at least sufficient to coagulate the protein and create a matrix which encapsulates the lipid. It is not necessary that heating be effected such as to significantly reduce the water content of the mixture. In general, the mixture should be brought to a temperature in the range 50 to 100°C, preferably above 78°C.

The necessary extent of heating is readily determined in practice - with too little heating pellets of the emulsion are soft and deformable, and they stick together and coalesce. With sufficient heating, such pellets are self-supporting, transportable and non-coalescing. Too much heating is unproductive as it destroys protein quality and lowers the nutritional value of the feedstuff.

The heating step which coagulates the protein is preferably effected using electromagnetic (e.g. microwave) irradiation, e.g. at a frequency in the range 10 to 3000 MHz, preferably in the range 900 to 950 MHz. The irradiation intensity is preferably in the range 0.025 to 0.5 kW per kg/hour of emulsion throughput, especially 0.05 to 0.2 kW/kg.h<sup>-1</sup>, more especially 0.075 to 0.15 kW/kg.h<sup>-1</sup>. The use of microwave frequencies of 900 to 950 MHz, especially about 915 MHz is preferred to the use of higher frequencies due to the increased ability to penetrate the emulsion.

Desirably the water content is reduced as little as

possible during the coagulation step, with further drying to the desired final moisture content being carried out in subsequent treatment steps, e.g. using hot air drying. For dry, storage stable feed, the final moisture content is preferably less than 10% by weight; however for feed for use without storage, moisture contents of up to 30% are acceptable. Moisture content may be determined conventionally, e.g. using an infra-red moisture analyser such as a Mettler Toledo HR73 Halogen Moisture Analyser.

Before the coagulation step, the emulsion is preferably extruded or otherwise formed into sheets, or more preferably "ropes" of 2 to 40 mm thickness, especially ropes of 3 to 25 mm diameter. If desired the emulsion may be formed in "pellets"; however it is generally preferred to cut such ropes into pellets after coagulation. Such pellet sizes may be for example 2 to 30 mm, preferably 3 to 20 mm.

If extruded or otherwise formed as sheets, the coagulated emulsion may be broken into flakes, cut into strips or otherwise transformed into particles of the desired size.

Particularly desirably, the emulsion is formed, e.g. into sheets or ropes, before coagulation; coagulated; cut into pellets or strips or smaller sheets; dried on a perforated belt in a multi-sector hot air dryer; and if desired broken into flakes. Especially preferably the emulsion is extruded into ropes before coagulation, coagulated, cut into pellets and then dried on a perforated belt in a multisector hot air dryer. In one preferred embodiment, in an early sector of the multi-sector dryer, air flow is through the belt from below so as to separate the pellets while in a later sector air flow is through the belt from above so as to enhance the drying effect. Desirably a still later sector is arranged to cool the dried pellets.

The dryer used in this embodiment of the apparatus of the invention is conveniently a multi-sector dryer such as those produced by Lindauer Dornier GmbH, Lindau, Germany for drying of pelletized sewage sludge.

Where the product of the process of the invention is a feedstuff, a wide range of dryers may be used, e.g. multisector dryers as described above, hot air drum dryers, flash dryers, etc.

In an alternative embodiment of the invention, following emulsification, and if desired degassing, the emulsion is passed directly into a drying means, thus forming a nutritional composition in granular form (e.g. powder, grain or meal form).

The drying means may optionally be a high temperature drying means, for example a disc-dryer, or a lower temperature drying means, for example a vacuum dryer, spray dryer or flash dryer. For dry, storage stable feed-meal, the final moisture content is preferably less than 10% by weight; however for feed or feedstuff for use without storage, moisture contents of up to 30% are acceptable.

In one particularly preferred embodiment, the nutritional composition is a feedstuff produced in relatively fine grained form, e.g. pellets of 2 to 5 mm size, or in particular meal form, substantially free of plant carbohydrates and plant oils. This powdered or granulated feedstuff may then be used as an ingredient in the preparation of feed pellets by conventional methods, e.g. by pelletization or extrusion with binders and plant carbohydrates and addition of fish and/or plant oils and other substances as discussed above (e.g. vitamins, pharmaceuticals, colouring agents, etc). The addition of fish and plant oils may be performed so as to achieve a desired balance of fatty acid residues (e.g. of  $\omega$ -3 and  $\omega$ -6 acids) in the final product, which can be used as a human or animal (e.g. mammal, fish, reptile, etc.) feed or food supplement.

After drying and cooling, the nutritional composition may be packaged for storage or transport, e.g. in water-proof plastics containers such as sacks or drums.

The nutritional composition produced using the process of the invention is novel and forms a further aspect of the present invention. Viewed from this aspect the invention provides a nutritional composition produceable by emulsifying and coagulating and/or drying a mixture containing raw fish.

Viewed from a further aspect the invention provides a nutritional composition containing fish oil and fish protein, preferably coagulated fish protein, which is substantially free of muscle fibre fragments in excess of 200  $\mu\text{m}$  in length, preferably a gluten-containing composition.

The apparatus used in the process of the invention is also novel and forms a further aspect of the invention. Viewed from this aspect the invention provides apparatus for production of a nutritional composition, one embodiment of said apparatus comprising:

- a grinder arranged to produce a ground raw fish mixture;

- an emulsifier arranged to convert the ground raw fish mixture into an emulsion;

- a heater arranged to coagulate the emulsion; and

- a dryer arranged to dry the coagulated emulsion.

Such apparatus preferably also comprises: a mixer to mix into the ground raw fish mixture other optional components such as vitamins, oils, minerals, gluten, starch, etc; a degasser to reduce the gas content of the emulsion; means for forming the emulsion into a desired form for coagulation in the heater, e.g. a spreader to produce sheets or an extruder to produce an emulsion extrudate; and a cutter to cut the coagulated emulsion into a desired form, e.g. a pelletizer to pelletize the

coagulated emulsion.

A further embodiment of the apparatus of the invention comprises:

a grinder arranged to produce a ground raw fish mixture;

an emulsifier arranged to convert the ground raw fish mixture into an emulsion and;

a dryer arranged to dry the emulsion.

Such apparatus preferably also comprises: a mixer to mix into the ground raw fish mixture other optional components such as vitamins, oils, minerals, gluten, starch, etc; a degasser to reduce the gas content of the emulsion.

Embodiments of the process, apparatus and products of the invention will now be described further by way of example and with reference to the following non-limiting Examples and to the accompanying drawings, in which:

Figure 1 is a schematic layout for an apparatus for the performance of the process of the invention;

Figures 2 and 3 are photomicrographs of emulsions used in the process of the invention; and

Figure 4 is a photomicrograph of a raw fish mixture that has been subjected to grinding and chopping but not emulsification.

Referring to Figure 1, there is shown an apparatus 1 for the performance of the process of the invention. Raw fish (e.g. whole herring) is transferred from receiving hopper 2 to a grinder 4 by screw feed 3. The ground fish is fed from grinder 4 to screw mixer 6 by screw feed 5. In screw mixer 6, a carbohydrate (wheat starch), pigment, gluten and vitamin mixture from hopper 7 is mixed with the ground fish and the resultant mixture is passed to a buffer mixer tank 8. The mixture from tank 8 is pumped by pump 9 into an emulsifier 10 where it is emulsified. The emulsion is passed into suction silo 11 and vacuum tank 12 where it is degassed at a pressure of 0.7 bar. The degassed emulsion is

pumped by pump 13 into extruder 14 which extrudes 12 mm diameter emulsion ropes onto a conveyor belt 15. Conveyor belt 15 transports the ropes of degassed emulsion through three heating sectors of a microwave oven 16 operating at 915 MHz. Water vapour from the oven is removed and condensed. The coagulated ropes leaving oven 16 are cut into pellets by cutter 17 and the pellets are transported into a seven-sector dryer 19 by belt 18. In the first three sectors of dryer 19, hot air is passed upwards through the perforated belt 20 carrying the pellets, and in the subsequent four sectors hot air is passed downwardly through the perforated belt. In a final sector, cool air is passed between the pellets and the dried and partly cooled pellets are subsequently sieved, cooled and bagged.

Example 1 - formation of emulsion

The following materials are used to produce an emulsion for feeding to a microwave oven in an apparatus according to Figure 1:

Raw whole herring	100 parts by weight
Gluten	5.13 parts by weight
Wheat starch	4.30 parts by weight
Vitamin mixture	0.08 parts by weight
Colouring agent	0.02 parts by weight

Photomicrographs of an emulsion of raw fish and carbohydrate produced in this way are shown in Figures 2 and 3. As can be seen, the emulsion contains oil droplets of 1-50  $\mu\text{m}$  size. By way of comparison, from Figure 4 it may be seen that grinding and chopping raw fish, as in the procedure of Hamre (supra), does not produce such an emulsion.

The emulsion flow at 500 kg/hr is subjected to 75 kW microwave irradiation at 915 MHz, pelletized and dried to a moisture content of 7%. The resulting feed pellets show negligible lipid leakage.

Example 2 - fat leak test

In order to demonstrate the stability of the fat in the product of the invention, the following pressure test was carried out.

Samples of crushed feed pellets formed by the process of the invention and of a well mixed blend of fish meal and fish oil were compressed in a specially designed test apparatus. Each sample consisted of 400g of material, with a fat content of approximately 43% of the dry mass. The following results were obtained:

		Pressure / Bar		
		4	8	17
Leakage from sample (g)	Crushed pellets	0	0	0
	Fish meal /oil mix	28	46	58

The results clearly show that the product of the invention gave no detectable fat leakage at pressures up to 17 bar, while the comparative mixture had lost more than 33% of its original fat content under the same conditions.



Claims

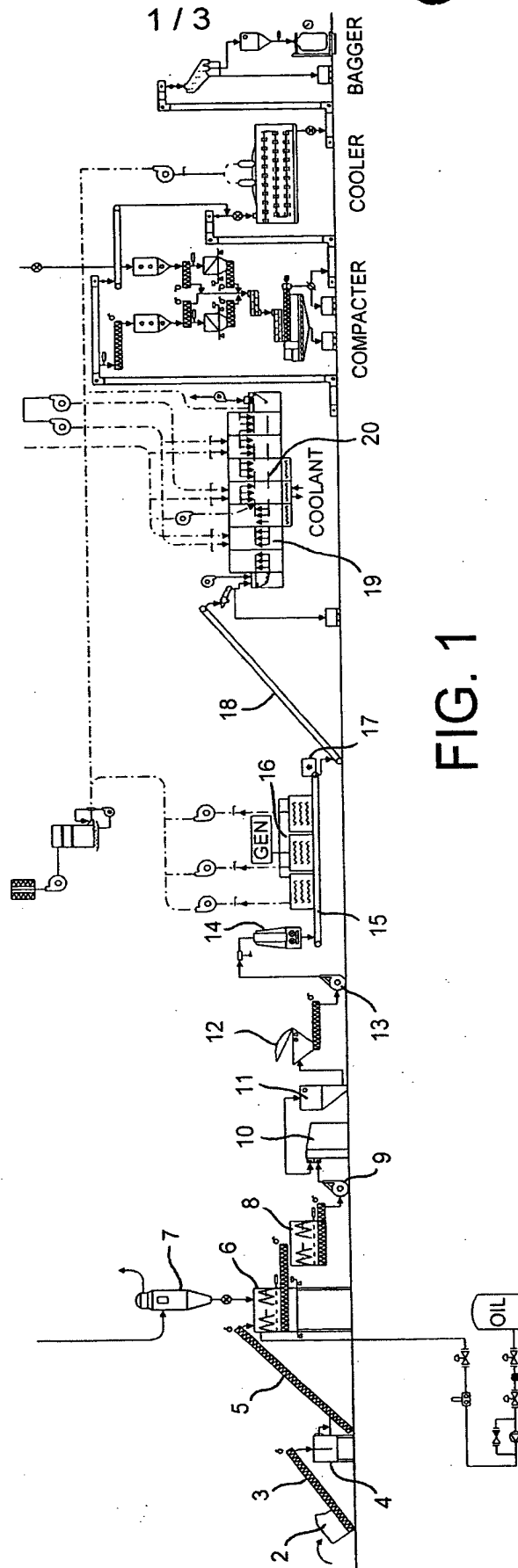
1. A process for the production of a nutritional composition, said process comprising emulsifying a material comprising raw fish and heating and/or drying the resulting emulsion.
2. A process of claim 1 wherein the emulsion is heated to coagulate the protein therein.
3. A process of claim 2 wherein the coagulated emulsion is further dried.
4. A process of claims 2 or 3 wherein the emulsion is heated by electromagnetic irradiation, preferably microwave irradiation.
5. A process of claims 1 or 2 wherein the emulsion is heated and dried by use of a disc drier.
6. A process of claim 1 wherein the drying is carried out using a belt drier, spray drier, flash drier or vacuum drier.
7. A process of claims 2 to 4 comprising the steps of extruding or the emulsion into ropes, optionally degassing the emulsion, heating the formed emulsion to coagulate the protein therein, drying the coagulated emulsion, and chopping the dried emulsion onto pellets.
8. A process of any of claims 1 to 7 wherein the material to be emulsified comprises raw fish and gluten.
9. A nutritional composition formed by emulsifying and coagulating and/or drying a mixture containing raw fish.

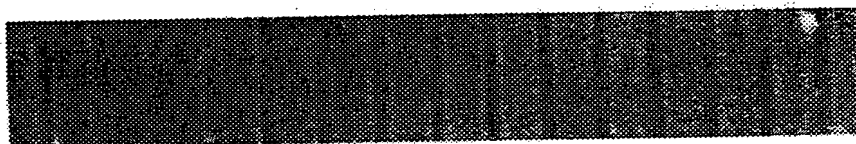
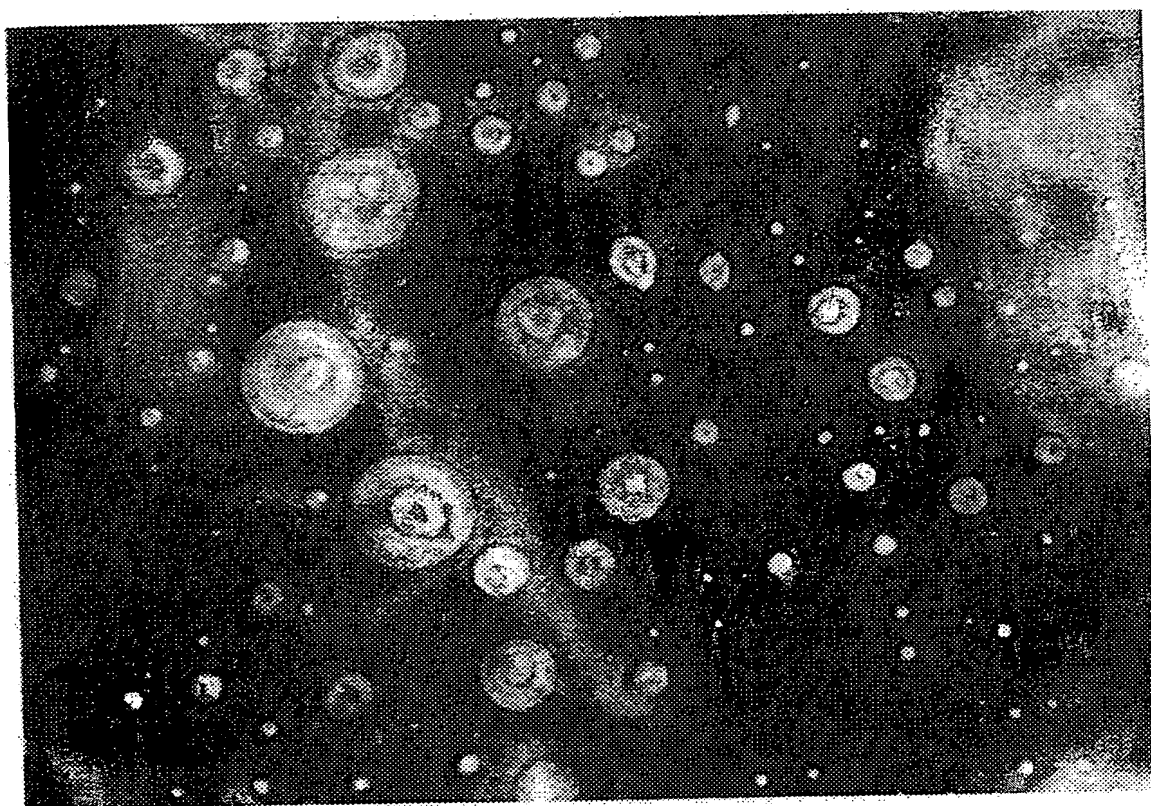
10. A nutritional composition containing fish oil and coagulated fish protein which is substantially free of muscle fibre fragments in excess of 200  $\mu\text{m}$  in length.
11. The feedstuff or nutritional composition of either of claims 9 or 10 further comprising a protein storage protein, preferably gluten.
12. The feedstuff or nutritional composition of any one of claims 9 to 11 wherein the lipid content is 15 to 55% by weight on a dry weight basis.
13. The feedstuff or nutritional composition of any one of claims 9 to 12 wherein the water content is 2 to 10% after drying.
14. The feedstuff or nutritional composition of any one of claims 9 to 13 wherein the mixture is exposed to a partial vacuum after emulsification.
15. The feedstuff or nutritional composition of any one of claims 9 to 14 wherein the final density is in excess of 1 g/ml.
16. An apparatus for production of a nutritional composition, said apparatus comprising:
  - a grinder arranged to produce a ground raw fish mixture;
  - an emulsifier arranged to convert the ground raw fish mixture into an emulsion;
  - a dryer arranged to dry the emulsion; and
  - optionally a heater arranged to coagulate the emulsion before it is dried.
17. The apparatus of claim 16 wherein the heating step is performed by electromagnetic irradiation, preferably microwave irradiation.

18. The apparatus of claim 16 wherein the heating and drying steps are performed by a disc drier or a hot air drier.

19. The apparatus of claim 16 wherein the drying step is performed using a hot air drier, a vacuum drier, a spray drier or a flash drier.

20. The apparatus of claim 16 wherein the emulsion is transferred directly to a disc drier, a hot air drier, a spray drier, a flash drier or a vacuum drier.





0 50 100  $\mu\text{m}$

FIG. 2

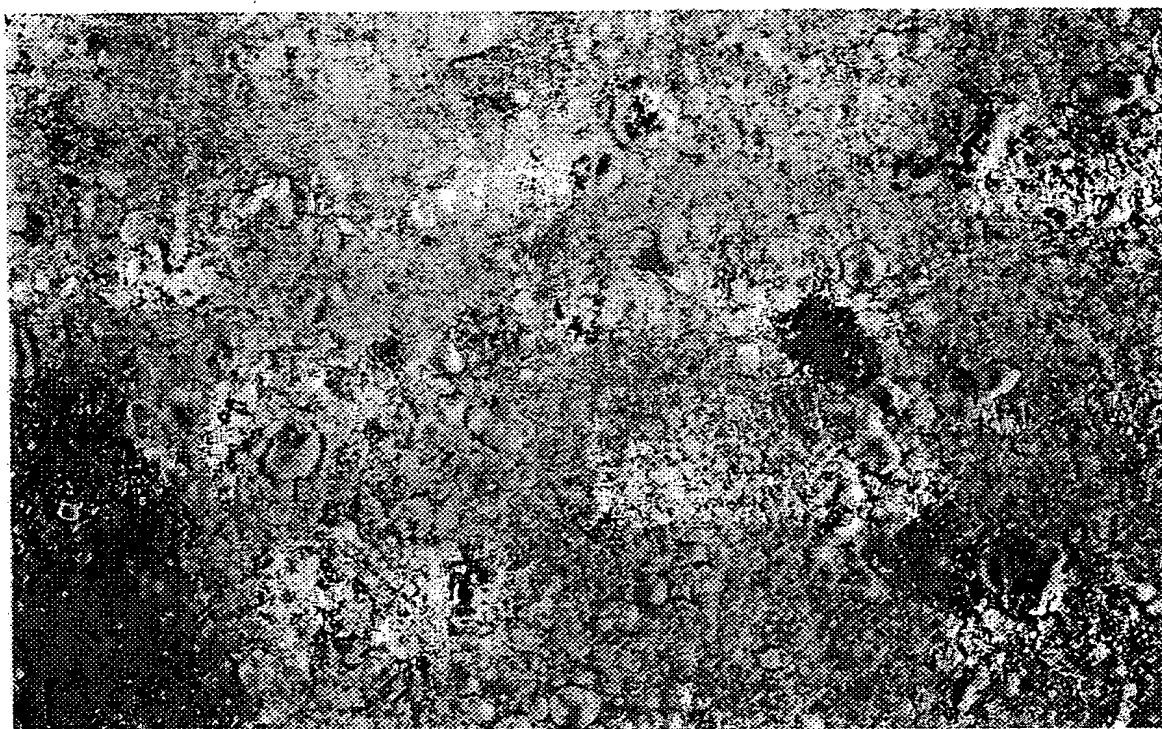


FIG. 3

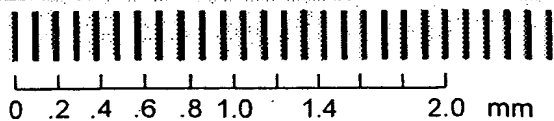
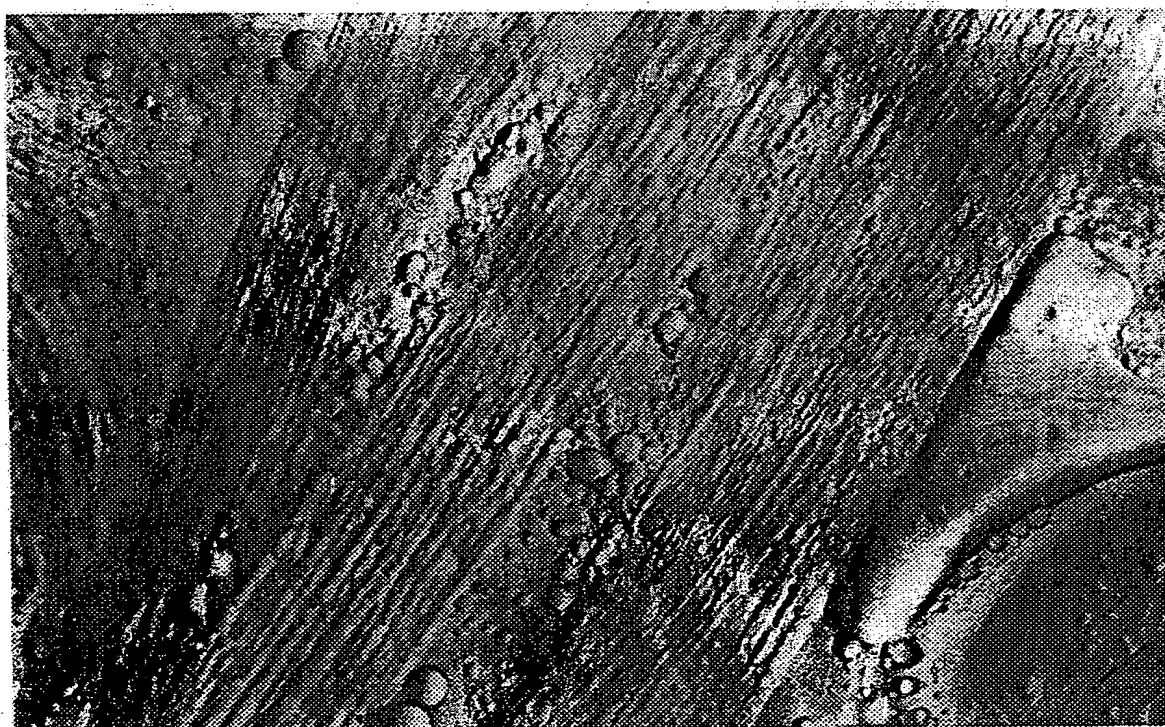


FIG. 4

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00615

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A23K1/00 A23K1/18 A23L1/325 A23J3/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A23K A23L A23J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	DATABASE WPI Section Ch, Week 8517 Derwent Publications Ltd., London, GB; Class D13, AN 85-102393 XP002108524 -& JP 60 047643 A (QP CORP), 15 March 1985 (1985-03-15) abstract	1-3,6,9, 10,12, 13,16,19

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search

17 May 2000

Date of mailing of the international search report

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00615

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